Botany at the American Association.

The botanical papers presented to the association at the Buffalo meeting were about the same in number and quality as last year. Those which may be classed as strictly botanical are six, as follows:

Asa Gray, Memoranda of a revision of the North American violets.

J. M. Coulter and J. N. Rose, Synopsis of North American pines, based upon leaf anatomy.

C. R. Barnes, A revision of the North American species of the genus Fissidens.

Lillie J. Martin, Plan for laboratory work in chemical botany.

W. J. Beal, The bulliform or hygroscopic cells of grasses and sedges compared.

W. G. Farlow, The development of the Gymnosporangia of the United States.

The several papers will eventually appear in the pages of the GAZETTE, and in this place it is only necessary to say a few words about them, and to summarize the discussions that followed the reading of them.

In the absence of the author, the paper on violets was read by Prof. Coulter. This paper and the two next mentioned, being so fully systematic, gave little occasion for discussion. One feature of Prof. Coulter's paper, the use of histological characters as the basis of arrangement, aroused much interest. Mr. Arthur commended the movement to bring such characters into use in classification, when found specially serviceable, and mentioned the success of Hackel, who used the tissue characters of the leaves to distinguish some of the difficult species and forms of the Festucas of Europe. Prof. Barnes alluded to the labors of Constantin and Vesque in discriminating plants by the characters of the leaves; they have taken up this work with the idea of making a complete key to the families. Mr. Morong desired to add testimony to the value of this method. He had recently been paying much attention to Naias, and finds that it is necessary to consider the cellular structure of the leaf and stem in order to decide between the species. He also said: "I am very glad to hear this paper, running somewhat in the same direction as my own studies. I wish botanists generally would feel more interest in the matter, for we have a large field open to us for new methods of systematizing."

Miss Martin's paper suggested the change which has come to

American botany in the last few years, and Mr. Arthur summarized this as starting with the collecting and classifying of flowering plants, afterwards embracing the lower orders of plants, reaching at the present time the stage when histology and morphology are receiving marked attention, with some notice given to physiology. "The chemistry of plants," he added, "is now investigated almost entirely by the chemists. If this paper does something to call attention to the fact that the chemistry of plants should be studied by botanists as well as by chemists, it will have served a most excellent purpose."

Prof. Beal's paper was illustrated with a large number of diagrams showing the position of the hygroscopic cells. A desire was expressed to know more regarding their function, a point not specially dealt with by the paper. This was explained; whereupon Prof. Burrill raised the query of how it happened that they so frequently occurred upon the upper surface of the leaf, if their office was to roll the leaf up in order to decrease evaporation and prevent the drying up of the leaves. When the leaves were rolled upon the upper surface, it exposed the under part, which usually has more stomata and softer tissues. Prof. Beal mentioned the fact, as a partial explanation, that many grasses habitually twist their leaves and present the lower surface to the sky. Prof. Pillsbury suggested a possible connection between the distribution of the hygroscopic cells and the folding of the leaf before vernation.

Dr. Farlow's paper was supplemented by numerous specimens of the different species of fungi that the paper dwelt upon, and some of the results of the cultures which furnished the principal data. Prof. Burrill spoke of the value of the paper as a basis of systematic study, and desired to learn the methods of conducting the experiments. Upon being assured that the details will shortly be published, he added that the results are of much economic importance. Upon the prairies of Illinois these fungi are doing serious harm. He had received a letter from an orchardist since coming to the meeting, in which he complains earnestly of acres of orchard being destroyed as the result of planting a cedar hedge around it.

Several other papers, which are in some measure botanical, should be spoken of in this connection. They are the following:

J. S. Newberry, On the cretaceous flora of North America.

E. W. Claypole, On some carboniferous wood from Ohio.

B. E. Fernow, Biology of timber trees with special reference to the requirements of forestry.

E. Lewis Sturtevant, Atavism the result of cross breeding lettuce; also A study in agricultural botany.

C. Richardson and C. A. Crampton, On the presence of cane sugar and allantoin in ungerminated embryo of wheat.

Lillie J. Martin, Preliminary analysis of leaves of Juglans nigra.

Helen C. DeS. Abbott, Certain chemical constituents of plants considered in relation to their morphology and evolution; also Preliminary analysis of a Honduras plant named 'Chichipate'.

V. C. Vaughan, Tyrotoxicon (cheese poison); its occurrence in milk.

W. McMurtrie, Blue milk and ropy cream.

D. E. Salmon and Theobald Smith, The bacterium of swine plague.

Theobald Smith, On the variability of pathogenic organisms as illustrated by the bacterium of swine plague.

D. E. Salmon, The theory of immunity from contagious diseases.

It is not possible for us to give more than a slight account of a part of these papers, except of two or three which will appear in our columns in the form of abstracts prepared by the authors.

Dr. Sturtevant's first paper described several lettuce plants grown from seed obtained from crossing two dissimilar varieties. One plant in particular much resembled the wild type, and the conclusion is reached that atavism has been one of the determining influences. The study in agricultural botany by the same author went to show that plants under cultivation have circumscribed limits of variation, and that the present type varieties, particularly of scorzonera, parsnip and carrot, probably originated from natural prototypes, and not by human selection.

The paper by Miss Martin and the second one by Miss Abbott were excellent examples of careful and valuable analytical work. Miss Abbott isolated a new camphor and a yellow coloring matter, specimens of which were exhibited. Miss Abbott's first paper, an abstract of which is to appear in the GAZETTE, excited very favorable comment. The subject is worthy the careful attention of botanists.

Prof. Vaughan's paper is of special economic interest. He traces the poisonous effects occasionally experienced from eating cheese and ice cream to the presence of a ptomaine, which he has called tyrotoxicon, and which from its nature and the circumstances attending its occurrence is believed to be due to a microorganism. He also points out that cholera infantum may be due to the same or a similar cause.

Prof. McMurtrie has studied the phenomenon of ropy cream from a chemical standpoint and finds no grounds for the opinion

that it is due to a simple physical or chemical change, but concludes that the evidence points to the presence of some form of bacteria. Prof. Burrill in discussing the paper stated that he had also given attention to the subject, and that while he did not doubt it was due to germs yet he had been unable to decide upon the particular kind. The blue milk spoken of in the title is an incidental accompaniment of the ropy cream, and is not the blue milk mentioned in works on bacteria.

Mr. Smith's paper is based upon observations of microbes obtained from three separate outbreaks of swine plague—one in the District of Columbia, one in Nebraska and one in Illinois. The microbes were identical in morphological, but different in biological characters. This variation is all the more interesting because not before admitted with any of the pathogenic organisms heretofore studied.

A considerable discussion followed the reading of Dr. Salmon's paper on the theory of immunity from contagious diseases, participated in by Drs. Minot, Arthur, Burrill, Bowditch and the author. Dr. Minot objected to the use of heated bouillon for testing the exhaustion theory. Dr. Arthur suggested that sterilization in such a case might properly be effected by filtration through porcelain; he also spoke of his own studies on pear blight as in some measure supporting the theory. Dr. Bowditch asked if the theory might not be extended to the lessened effects experienced from the continued bites of insects. The author thought it could.

Botanical Club of A. A. A. S.

The meetings of the Botanical Club have increased in attendance and interest from its organization, three years ago, at Minneapolis. The fourth meeting, just held at Buffalo, brought together more botanists than ever before, and still further compacted an organization which has in it the promise of great usefulness. Ninety-one names were entered upon the register slips, but the knowledge that several botanists neglected to register makes it more than probable that over one hundred were in attendance. This gives a very large percentage of botanists in the general association, and also adds weight to the thought expressed by some that there should be a section of botany.

The term botanist, of course, includes a great variety of persons, from those merely interested to those professionally engaged in botanical work, but as one of the objects of the club is to stimulate a general interest in the subject, all such persons are legiti-

mately included. It is not easy to classify the departments entered upon the registration blanks, but the expressed preference of the ninety-one botanists entered may be summed up as follows: General botany, 11; flowering plants and ferns, 17; cryptogams, 15; minute anatomy, 4; chemical botany, 2; agricultural botany, 1; medical botany, 1; physiology, 3; morphology, 2; no preference stated, 35.

Four meetings were held, at 9 o'clock A. M., and the attendance was always large. As these meetings were supplemented by excursions and receptions given by the local club, it may be said that the botanists saw a great deal of each other. The social feature was especially prominent and a general feeling of good fellowship was always present. The papers presented to the club, as a rule, were more substantial and more carefully prepared than ever before. As most of them will be published in full or by abstract in this and subsequent numbers of the GAZETTE, they will not be referred to at any length in this account. Following is a brief summary of the proceedings and discussions of the club:

Prof. J. M. Coulter was chairman for the year, but in his absence on Tuesday, Prof. W. J. Beal presided. Dr. J. C. Arthur, the secretary-elect, was compelled to resign his position, owing to his duties as secretary of the section of biology, and Dr. N. L. Britton served in his place.

THURSDAY, August 19, 9 A. M. After a few introductory remarks by the chairman, a letter from Dr. Asa Gray was read to the club, followed by his paper entitled "Essay toward a revision of Dodecatheon," both of which are published elsewhere in this issue. Prof. E. W. Claypole then read a paper upon the potato rot. During the fall of 1885 this parasite was very abundant in some parts of the country, and the author undertook to study it in his own locality (Akron, Ohio). After describing the structure of a potato tuber, he observed that the parasite attacked the eyes and affected the fibro-vascular region of the tuber, leaving the interior starch cells intact.

Mr. F. V. Coville read a paper upon *Aconitum Noveboracense* Gray, n. sp., as occurring at Oxford, New York.

Prof. F. L. Scribner displayed an apparatus he had been using for making microscopic drawings. It was a device for using the camera lucida with simple lenses, and thus obtaining an amplification of a few diameters. Questions were asked and suggestions made by Professors Burrill and Beal.

Dr. W. J. Beal displayed a contrivance for facilitating laboratory work. It consisted of a device for holding all the ordinary

laboratory accessories used by the student, thus enabling him to get them out and put them away speedily, and to have them always convenient while at work. The box was arranged to hold everything, from sandpaper to objectives. In the discussion that followed Prof. Pillsbury thought that holes bored in a block would be less expensive for holding reagent bottles than box-like compartments. Dr. Farlow thought it rather dangerous to have reagent bottles placed so near objectives.

A communication from Dr. A. Gattinger was read, in which was described Hypericum lobocarpum, a new species from the mountains of Tennessee.

W. H. Seaman, of Washington, read a paper on Marsilia quadrifolia. Plants of this species had been procured from Germany by the Fish Commission and cultivated as a fish food. Proving to be rather injurious to fish than otherwise, an attempt was made to destroy it. But the plant has spread and is likely to become permanently introduced.

Dr. Beal stated that Marsilia had become a thriving plant in central Michigan.

FRIDAY, August 20, 9 A. M. Rev. Thomas Morong had a few words to say concerning Marsilia. He said that it would take possession and drive out everything else, even witch grass. He had seen a small patch take possession of a pond and drive out every other aquatic. The first put out was twenty years ago, at Bantam Lake, Litchfield, Conn. "I find it has gone along the shore for half a mile and has taken complete possession of the ground."

Professor L. M. Underwood, in continuing the discussion, said that Marsilia was originally found at Bantam Lake and also at another widely separated locality. When first found it was in small quantities. He would ask Mr. Morong how he would account for that fact.

Mr. Morong replied by stating that Dr. Gray had recently sent him a specimen of Potamogeton crispus from Arizona, and he would like to ask how it had skipped from the Atlantic seaboard to Arizona.

The discussion was further continued by Professor Underwood with reference to other species.

Professor T. J. Burrill next described simple and inexpensive ways of making apparatus for fluid cultures and sterilizing. The author will fully describe these devices in the next number of the GAZETTE. It is sufficient to say that they exactly meet the demands of many workers who are unable either to purchase or devise such appliances.

Mr. Morong exhibited some Potamogeton fluitans from Niagara river.

Miss Lillie J. Martin read a paper in which she recommended the use of petroleum spirit (boiling 25°–45° C.) for the preservation of plant tissues. The subject was discussed by Mr. Seaman, Professor Barnes and Miss Martin.

Professor B. E. Fernow exhibited a branch from a chestnut which bore spikes of small burrs, and at a distance looked like a chinquapin. The tree grew wild in a wood-lot, in Lehigh Co., Pennsylvania. All the other trees have the same condition of development, and no cause for this freak could be discovered. He was inclined to think that it was self-fertilizing, but no male flowers were discovered.

Professor Underwood asked if there was any evidence of an injury, as he had often observed that injuries in certain plants tend to produce abnormal development, but Mr. Fernow had discovered none.

Professor Burrill called attention to the fact of the side shoots of Indian corn, near the base, bearing both sorts of flowers, the tassels coming out in the ordinary way, and in the tassels more or less female flowers. In husk corn this is a common thing.

The discussion was continued by Messrs. Beal, Farquhar and Fernow, and Mrs. Walcott.

Dr. W. J. Beal spoke of the escape of the seeds of Sporobolus cryptandrus.

MONDAY, August 23, 9 A. M. The time for the election of officers for the ensuing year having arrived a committee on nominations was appointed, and their report as follows unanimously adopted: For chairman, M. S. Bebb, of Rockford, Illinois; for secretary, Mrs. E. L. Britton, of New York city.

F. L. Scribner read a paper upon the occurrence of the orange scab in Florida, a disease which is comparatively new and which threatens to destroy nursery stock.

Prof. J. H. Pillsbury described a method of making lantern slides for micro-photographs, which is really very simple and ingenious. He obtains some tracing gelatin (which comes in very fine sheets), taking care to select sheets that are not much scratched. They can be obtained of every color and form. The piece of gelatin is put over any desired diagram, and with a very fine steel point (such as lithographers use) the diagram can be traced upon the gelatin. Slipping the gelatin between two pieces of glass a lantern slide is the result, which is convenient for all kinds of illustrations. These slips of gelatin can be purchased at almost any lithographic establishment. In this way a teacher

can reproduce accurately for class illustration any published figure, and with great economy of time and money.

Professor Burrill stated that he had made lantern slides from blackboard drawings. By making the chalk lines even and dense a photograph can be taken with very good effect.

Professor Barnes upon inquiry brought out the fact that the scratches upon the gelatin appear as black as ink lines against a white surface.

Dr. N. L. Britton read a paper upon the herbaria of Columbia College. The description of the herbarium cases caused considerable discussion, by Professors Pillsbury, Britton, Beal, Barnes, Sargent, etc.

Prof. Barnes thought that the most commendatory convenience spoken of was the tightly fitting glass doors.

In the discussion with reference to dust-proof devices, it was generally the opinion that a working herbarium can not be made dust proof, as the doors are of necessity open so much of the time, and the only way to keep the specimens in proper condition is to exercise "eternal vigilance."

Dr. N. L. Britton read a paper upon Anychia dichotoma, of which he discriminated two forms, which might possibly merit specific rank.

TUESDAY, August 24, 9 A. M. Professor E. W. Claypole read a paper upon the appearance of immigrant plants in the neighborhood of Akron, Ohio, which was discussed by Messrs. Morong and Coville.

Professor F. L. Scribner then presented a paper upon the botanical character of the black rot of the grape.

The following resolutions were then adopted:

Resolved, That the members of the Botanical Club of the A. A. A. S. heartily thank the U. S. Commissioner of Agriculture for his promptness and energy shown in appointing an able investigator to prosecute the mycological work recently inaugurated in the Department of Agriculture, and in giving him opportunities to study the fungi which are injurious to cultivated plants. While they are gratified with the beginning made, they express the hope that this work will be still further supported. The botanists here assembled hereby renew their promise to render the U. S. Commissioner of Agriculture any assistance in their power toward making investigations in any department of botany.

Resolved, That the hearty thanks of the Botanical Club of the A. A. A. S. be tendered to the Botanical Club of Buffalo for the bountiful hospitality which they have shown to their brethren from abroad, and not less for the graceful and courteous manner in which this hospitality has been extended, with the promise that wherever our meetings may be held in the future every visiting Buffalo botanist will find a warm reception in our hearts and homes.

The presiding officer tendered the thanks of the club to Dr.

Arthur for his efficient work in arranging for their meetings, and the club adjourned to meet next year at 9 A. M. on the second day of the meeting of the A. A. A. S.

Entertainment of the Botanists at Buffalo.

Fortunately for the Botanical Club of the Association, Buffalo possesses a very active Botanical Club, and the members of this company vied with each other in devising and executing plans for the entertainment of the visiting botanists. Time did not allow the placing on the program of a tithe of the generous ideas their hearts suggested, but their spirit was shown by the numberless little things which were done to make pleasant the meetings. Three special rooms were set apart for the accommodation of the club, and the unavoidable school-room bareness was relieved by the easy chairs, pictures and statuary which thoughtfulness had provided.

The special reception announced upon the program was held on Thursday evening, from 8 to 11, at the residence of Hon. David F. Day, on Cottage street. With a view to making strangers feel personally welcome, the local club took the trouble to issue special cards of invitation, supplementing thus the general invitation, and in response to these two hundred and fifty cards fully as many people assembled at Mr. Day's hospitable home. Thursday had found the ladies of the club busy in decorating the four spacious rooms given to the reception. The mantels were banked with native flowers, and vases, bowls and dishes held a profusion of wild blossoms, some of which puzzled those not acquainted with the Buffalo flora to name. Of all these, most honored was Epipactis Helleborine, the rare orchid of Syracuse and Buffalo. Many of the native flowers were supplied by Mr. Day's grounds—which constitute, by the way, a botanical garden of no mean proportions—while others represented much active collecting by the members of the club. Beside all these, every available place was filled with exotics, whose graceful foliage or peculiar forms added much to the beauty of the rooms. The blooming of a Cereus was awaited with interest, but in vain, as it did not open until the following night. The center piece on the well-laden table was a huge block of ice hollowed out and filled with wide-open water lilies.

As everything possible in the way of decoration was done to make the rooms beautiful, so was everything possible done to made the guests feel at ease and to relieve the too common stiff-

ness of a formal reception. So admirably did these plans succeed that every one spent a most delightful evening, and many pleasant acquaintances sprang up between the guests and their entertainers, which will not soon be forgotten.

The prompt and efficient service in the bountiful supper-room added not a little to the pleasure of a charming evening. Certainly the thanks of the botanists present were due to the local club, and especially to the distinguished botanist who placed his house at the disposal of the club.

The majority of the botanists went on the excursion to Niagara Falls on Saturday, and thoroughly enjoyed the grand scenery and varied flora which surrounds the Falls, especially that of Goat Island. The rare Hypericum Kalmianum, Gymnostomum curvirostrum and Fissidens grandifrons were the chief finds.

On Monday afternoon at 1:30 the club embarked on the steamer *Huntress* for the hour's ride to Point Abino, on the Canada shore. The day was cloudy and promised to be delightful for water travel, but half an hour out a hard rain set in, which kept the passengers busy avoiding the rills of water which coursed over the deck in various directions with the roll of the boat. Cruising off shore for half an hour until the rain ceased gave pleasant time for social enjoyment and improving the acquaintances begun at the reception. As soon as practicable the boat drew up to the long pier, built for loading sand-barges, and the merry crowd disembarked. Point Abino is a sandy cape backed by a range of low dunes, so that as soon as the rain ceased the surface was dry and comfortable for walking. At the end of the pier the party divided, some going under the leadership of Prof. Kellicott to a sphagnum swamp near by, while others under the guidance of Mr. Day walked along the shore towards the point. Here Hypericum Kalmianum and Calamintha glabella were the rarities, while a magnificent growth of Junipers attracted much attention.

After a ramble of an hour and a half, the warning blast from the boat's whistle brought in the stragglers. Scarcely were the last ones aboard when down came the considerate rain. But little cared we who had had our full time ashore, and still less cared we when sandwiches (assorted styles), cake and lemonade in lavish abundance were served. The discussion of deep botanical problems mingled with jest and laughter in consonance with the varying moods of the knots about the deck. No witness of the scene could doubt the thorough enjoyment of it by all. By dusk the boat touched her wharf (again the rain ceased) and we bade our hosts good night and good-bye, with many assurances

of our pleasure in the excursion so admirably planned and so happily executed.

As the Botanical Club of the Association has never before been so well attended, so also has it never before been so hospitably cared for and so happily entertained as at Buffalo. What more can they do for it in 1896?

Essay toward a revision of Dodecatheon.*

ASA GRAY.

Probably every botanist who has turned his attention to this genus has suspected it to be of more than one species. But those who have attempted to deal with the numerous now extant forms have been baffled in their endeavors to distinguish and define them. In the Synoptical Flora of North America I could do no better than to arrange the forms loosely under seven varieties. If I have now done better in the attempted discrimination of five species the credit is largely due to indications and specimens supplied to me by two western correspondents, Mr. Suksdorf, of Washington Territory, and Prof. L. F. Henderson, of Oregon, to the latter especially in pointing out to me the anomalous character of the form which I have accordingly designated by his name.

If the assigned characters hold out it will be in good part by their fruits that we shall know them; and fruit is rare in our specimens, so that many of them can only be guessed at, and the value of the present scheme is still to be tested. But present indications point to five species, the principal characters of which are exhibited in the subjoined

Clavis Dodecatheorum.

A. Short filaments manifest, being inserted at the very orifice of the short corolla-tube, and distinctly monadelphous: leaves with tapering base.

1. Capsule acute, coriaceous, opening at apex by valves: Eastern. D. Meadia.
2. Capsule obtuse, coriaceous, opening at or from the apex by valves: Western.

Leaves from narrowly or elongated to obovate-spatulate: capsule oblong to cylindraceous, usually much surpassing the calyx. D. Jeffreyi.

Leaves obovate or oval with cuneate base, short: capsule globular, hardly surpassing the calyx. D. ellipticum.

---

* Read before the Botanical Club of the A. A. A. S., Buffalo meeting, 1886.

3. Capsule obtuse, thin, cylindraceous, or suburceolate, surpassing the calyx, truncately dehiscent by circumscission of the apex: leaves obovate. D. HENDERSONI.

B. Anthers seemingly sessile, the very short and distinct filaments being inserted below the orifice of the corolla and included in its throat[1]: leaves ovate or obovate, often abruptly contracted into the margined petiole. D. FRIGIDUM.

1. D. MEADIA L., the original species, and the only one of the Atlantic region, has an acute capsule, of coriaceo-crustaceous texture; the narrow and obtusely acute apex, of slightly different color from the rest, but of same texture, opens into five dentiform valves, which hardly ever dehisce further down. There are plentiful Rocky Mountain specimens (such as are represented by the *D. integrifolium* Hook. Bot. Mag. t. 3622, from the north, and by Fendler's no. 549 from New Mexico) which probably go with this; but fruit is wanting.

2. D. JEFFREYI Moore, in Van Houtte, Fl. des Serres, xvi. (1867) 99, t. 1662. The figure represents a large and robust form of a common Pacific coast Dodecatheon, the firm and erect leaves of which are said to be at least a foot long, and the scapes and peduncles are correspondingly grandiose. But it is added that in dry soil the plants are small and weak. It is said to have come from the Rocky Mountains, but it represents a form which we have only from the Pacific coast, where it is probable that Jeffrey gathered the seed. It is just the *D. integrifolium* of Bongard, and var. *vegetius* of Ledebour Fl. Ross. from Sitka, etc., the *D. Meadia*, var. *macrocarpum* of the Synop. Flora, also the var. *lancifolium* of the same, a form with usually shorter capsules. As var. ALPINUM we may for the present include the *D. Meadia* var. *alpinum* of the Synoptical Flora; but fruit of those small and narrow-leaved mountain forms is still little known. As far as seen it is fusiform, cylindrical and narrow, but whether blunt or pointed is not so clear. With little doubt the *D. Meadia*, var. *frigidum* Hook. f. Bot. Mag. t. 5871 belongs to *D. Jeffreyi*. The stamens as well as the leaves are not those of *D. frigidum*. As at present received the species ranges from Sitka to the Guadalupe Islands off Lower California.

3. D. ELLIPTICUM Nutt. ex Durand in Jour. Acad. Philad., ser. 2, iii. 94. *D. Meadia*, var. *brevifolium* Gray, Syn. Fl. ii. 57. *D. integrifolium* Benth. Fl. Hartw. t. 322. This is rather common in California, from San Diego county, and San Bernardino, ap-

[1] I can not agree to the statement of the late Mr. Durand (in Jour. Acad. Philad. ser. 2, iii, 95)—excellent observer though he was—that the filaments are unconnected in D. Meadia and its near allies: they are certainly monadelphous into a ring or short tube in the flower-bud and in anthesis in all the species except D. frigidum, separating only as the gravid ovary enlarges.

parently not on the mountains, and northward to the Columbia river. From the latter I have unusually large specimens, coll. by Suksdorf, in springy places on rocks, Columbia river, with flowers collected in April and fruit in May. I presume this to be Nuttall's species, taken up by Durand, who well describes it though without the fruit, which I have well formed only from Suksdorf. If I mistake not it extends to St. Lawrence Bay on the Asiatic Coast; for to this (though without fruit) I incline to refer some specimens there collected by Eschscholtz (unless there has been confusion of localities) and which have entered into Chamisso and Schlechtendal's description of D. frigidum. For the two taller out of four small plants from the herbarium of the St. Petersburg garden, ticketed by Herder, have the well-exserted stamen-tube of the present group. If not D. ellipticum they must belong to a depauperate D. Jeffreyi, which extends well northward. D. ellipticum should be distinguished by its globular or short-ovoid capsule, barely equaling or slightly surpassing the calyx (if this character holds out); also by the shorter and blunter anthers.

4. D. HENDERSONI. Prof. Henderson, in sending me excellent specimens of this peculiar species (collected in Tualatin plains, Oregon), called my attention to its character. The broad and short leaves are like those of *D. ellipticum*, and the flowers are similar. But the capsule is chartaceous in texture, when well grown nearly twice the length of the calyx, cylindraceous-oblong, becoming urceolate as the placenta enlarges and the open summit broadens: the short more or less hemispherical apex becomes more distinctly circumscribed than in other species and at length falls away (along with the style) *as a lid*, and the truncate orifice seems indisposed to split up at all into valves. Upon searching among my specimens which had been referred to *D. Meadia*, var. *brevifolium*, I detect this species from Clear Water, Idaho, in the old collection of the late Mr. Spalding; from W. Klikitat county, Washington Terr., April, 1883, coll. Suksdorf, on mountain sides; also, but less marked, from the south side of Tamalpais, California, at the elevation of 2000 feet, coll. Brewer (1862), who notices it as quite unlike the form in the valleys below. This is the only species which in this revision demands a new name; and it may properly bear that of the acute observer who indicated its peculiarity.

5. D. FRIGIDUM Cham. & Schlecht. in Linn. i. 222, at least partly; Hook. Fl. i. 119; Seem. Bot. Herald, 38. t. 9. *D. Meadia*, var. *frigidum* Gray, Syn. Fl. l. c. The very short filaments in this species I find to be distinct down to the insertion in the

throat of the corolla, manifestly below the orifice: in anthesis they do not show at all; later they may slightly project. According to Seemann's figure the "not quite ripe" capsule is ovoid and slightly longer than the calyx. This figure accords well with the specimens from coll. Wright, of Arakamtchetchene Island, Behring Strait; from Arctic Alaska, Muir; and Lake Lindeman at the head of the Yukon, Lieut. Schwatka. Originals from Chamisso, and part of those from St. Lawrence Bay, Eschscholtz, are similar but smaller.

Var. DENTATUM. Larger: leaves with blade from one or two to three or nearly four inches long (in the dried specimens thin), oval or ovate to oblong, commonly repand or sparingly dentate, at base abruptly or truncately contracted into long and wing-margined petioles: scapes a span to a foot high, 2-7-flowered: corolla so far as known white: capsule globular- to oblong-ovoid, moderately surpassing the ovate or triangular-acuminate calyx-lobes, half-5-valved.—*D. dentatum* Hook. Fl. i. 119. *D. Meadia*, var. *frigidum* Watson, Bot. King Exp. partly. *D. Meadia*, var. *latilobum* Gray, Syn. Fl. l. c. The "N. W. Interior, Douglas" is probably interior of Oregon. Lyall collected it in 1850 on the east sides of the Cascade Mountains in Washington Terr.; Brandegee in the same region in open woods in 1883; Suksdorf in 1885, at the foot of a waterfall near Bridal Veil in N. E. Oregon; Henderson in 1884 and 1885 on wet rocks, along bluffs of the Willamette; Howell near the Cascades in 1886. The most southern and remote station is that of Watson in the Wahsatch Mountains, Utah, at the head of Cottonwood Cañon. It has all the essential characters of *D. frigidum*, but is much larger.

The Development of the Gymnosporangia of the United States.*

W. G. FARLOW.

The study of the connection between the different forms of Gymnosporangium and Roestelia known in the United States has not been by any means as simple as the similar study in Europe. This is owing, perhaps, to the fact that we have about double the number of species found in Europe, and it has not always been easy to determine exactly which of our forms were the same as those of Europe, or even clearly to define our own species. Before one could begin to study the connection between the Gymnosporangia and Roesteliæ, it was necessary to have a compara-

*Read before the A. A. A. S., Buffalo meeting, 1886.

tively clear notion of the species as distinguishable by their gross and microscopic appearances, for, until that was the case, any account of cultures made would be quite unintelligible. Nor could we hastily assume that those of our Gymnosporangia, which appear to be very much like European species, must have the same Roestelia form as in Europe. Practical experiment by cultures is the only method of settling the question effectually. If the anatomical characters are the same, and if the sowings of the spores are followed by the same Roestelia in both cases, then our form and the European belong to the same species, otherwise not.

In a paper published in 1880, I attempted to take the first step by collating what had been written about our species and supplementing it by observations on a large amount of living and herbarium material, so as to be able to form an estimate of the comparative distribution of both our Gymnosporangia and Roesteliæ, and, as far as our knowledge then allowed, to learn something of the probabilities of the connection between different forms; for we must naturally assume that, if there is any natural connection between Gymnosporangia and Roesteliæ, the connected forms will be found growing near together rather than separated by long distances.

In the paper mentioned I also gave an account of some cultures of Gymnosporangium spores on different hosts for the purpose of finding out what Roesteliæ followed the sowings. Although spermogonia in abundance followed some of the sowings, the æcidia themselves did not develop, and hence it was impossible to be sure of the species, although one could perhaps infer something. In northern and central Europe where the species of Roestelia are by no means as numerous as with us, some botanists who, on sowing Gymnosporangium spores, have obtained only spermogonia have at once assumed that they belonged to the Roestelia growing on the same host in nature.

This assumption, somewhat dangerous it must be admitted, might perhaps be allowed in Europe where the species are few, but would be quite unwarranted in this country where not only do most of our Roesteliæ grow on several different hosts but, in several cases, the same host is known to support several different forms of Roestelia. Although my cultures were not conclusive at all, taken in connection with what was known of the comparative natural distribution of the forms in question, they afforded, in a measure, some guide to the direction in which we might expect more definite information in the future.

Since 1880 my cultures have been continued at intervals, without, however, the production of æcidia, and in the meanwhile

our knowledge of the natural distribution of the species has been enlarged and emended in several respects. In the present connection I wish to speak only of the forms found east of the Rocky Mountains, of which the enumeration given in 1880 is still correct with one exception. There is to be added one species from the Rocky Mts., but it can not enter into the present discussion. Of the different notices on the subject which have appeared since 1880, I need refer only to a paper in the Proceedings of the Am. Academy of Arts and Sciences, issued in Feb., 1885, in which, after summing up all the evidence to be obtained from my numerous cultures and what was known of the distribution, I came to the conclusion that: first, *Gymn. biseptatum* Ellis, and *Roestelia botryapites* Schweinitz were probably connected; secondly, that *Gymn. globosum* Farlow might possibly be connected with *R. aurantiaca* Peck; thirdly, that *Gymn. macropus* Lk. has as its Roestelia a form growing on apples and Amelanchier.

Last spring cultures of several species of Gymnosporangium were made by Mr. Roland Thaxter, a student in the cryptogamic laboratory at Harvard, and the results which he has obtained are of great interest. The details will be given in a paper by Mr. Thaxter and I should like, in this connection, to call attention to some of the principal results reached. To start with the simplest case. The cultures of the spores of Gymn. biseptatum on two plants of Amelanchier were followed by spermogonia in ten days and later the æcidia began to form on the under surface of the leaves. Although the peridia are not yet ripe there can be no doubt that the species is R. botryapites, as the tubercular swellings produced can not be mistaken for those of any other species known in this country. Furthermore, in the cultures as in nature this Roestelia has developed very slowly, and it is highly probable that the æcidia will ripen as, when growing wild, the tubercles appear in July and August, but the ripe peridia are not found until some time in September, in Massachusetts. This case affords then a confirmation of the first statement mentioned above.

My second supposition has been proved by Mr. Thaxter's cultures to be incorrect. The spores of Gymn. clavipes growing on Juniperus Virginiana were followed by spermogonia in ten days when sown on Amelanchier and apples, and in about a month were followed by ripe æcidia on the stems of Amelanchier. This culture was the most striking of any. The æcidia were luxuriantly developed and the species was seen to be without doubt R. aurantiaca. In this culture furthermore the spermogonia appeared principally on the leaves while the æcidia were on the

stems, and this is known to be the case when the species grows wild. On apple only spermogonia appeared, but it is well known that the species not unfrequently grows on apples. It might be asked whether the result of this culture is not at variance with what is known of the distribution of Gym. clavipes and R. aurantiaca? The last named species is known to have a wide range but it has been believed that the Gymnosporangium was confined to the eastern parts of the country where it is not so common as some other species. That it is more common in the East than has been supposed is shown by the fact that it was found on Juniperus communis at Weymouth, Mass., by Mr. J. E. Humphrey last spring, and abundantly on the same host at Kittery, Me., by Mr. Thaxter. On J. communis the fungus is more easily recognized than on J. Virginiana. On both hosts it is generally found on the stems and is recognized by the reddish color, rather than the brown or yellow found in other species. The pedicels are much inflated at the top and the spores quickly fall from the pedicels and germinate almost invariably at both extremities. With this I had confounded a foliicolous form very common on J. Virginiana near Cambridge, which produces the birds-nest distortions. The fungus as in this case is rather brown than red, but the pedicels are often much swollen at the tip, and the spores in some cases germinate at the two extremities. If in this form the pedicels are sometimes quite as much swollen as in Gym. clavipes, it should be said that sometimes they are not much swollen and while in Gym. clavipes the germination is almost invariably at both extremities in the foliicolous form under consideration the germination is only occasionally so, as I find by repeated experiments. The near relationship of G. clavipes to G. conicum was pointed out in my first paper. I now think that the true G. clavipes is specifically distinct from the foliicolous form which produces the birds-nests, and the latter form, together with a stem form, should be referred to Gymn. conicum. But to return to the true Gymn. clavipes as it grows on stems. It must be admitted that, so far as we yet know, the Roestelia aurantiaca extends much farther west and south than the Gymnosporangium with which from Mr. Thaxter's cultures it appears to be connected. It should not be forgotten, however, that the Roestelia is the most striking of the genus and is found on common cultivated plants, whereas the Gymnosporangium usually grows in company with the much more conspicuous G. macropus and G. globosum, and is much more likely to escape observation. Now that we know that it occurs on J. communis as well

as J. Virginiana botanists may, perhaps, discover the species in regions where it is not now known.

Taking next the form which grows on Juniperus Virginiana and produces the well known birds-nest distortions, sowings were made on Pyrus Americana, apple, Amelanchier, and Pyrus arbutifolia and spermogonia appeared in great abundance on Amelanchier in seven days and on one apple in eight days and in a month æcidia developed on Amelanchier. The species was R. cornuta which is considered in Europe to belong to Gymn. conicum. Why the æcidia did not also develop on Pyrus Americana, the host on which R. cornuta occurs in its most marked form in this country, is a question. The failure in the present case may be merely an accident and future cultures may succeed. At any rate, the experiments should be repeated several times before we conclude that the spores of the birds-nest form will not grow on Pyrus Americana. Considering the distribution, the result of the cultures, and in general the anatomical structure, I think that it is most probable that the species is Gymn. conicum which Oersted concluded from his cultures to be connected with Roestelia cornuta. We must, however, ask one question. In Europe this species grows on Juniperus communis and, if our form on J. Virginiana is really the same, how does it happen that in this country the species is entirely unknown on J. communis which frequently grows in fields with J. Virginiana? I know one small field in which the two junipers grow mixed together, and although I have watched for years I have never found any Gymnosporangium on the J. communis there although the Gym. conicum so-called is abundant on the J. Virginiana.

Cultures were also made of the spores of Gym. clavariæforme, a species which grows on J. communis, and has apparently been more abundant this year than usual. Although sown on Pyrus Americana, apples, and Cratægus they only grew on the Cratægus where they produced Roestelia lacerata, the æcidium which in Europe is believed to be connected with the same species. In general the distribution of the Gymnosporangium and the Roestelia is about the same in the north and west, although the latter is much more common and is found in places not very near juniper trees.

Gymnosporangium Ellisii is, for some reason or other, less easily cultivated than the other species. In my cultures no results were obtained. In Mr. Thaxter's cultures when sown on Pyrus arbutifolia the spores seemed to cause spots on the leaves but no spermogonia or æcidia developed. It may be possible that the species is connected with Roestelia transformans which occurs on the Pyrus.

There remains to be considered two species, Gymn. macropus and Gymn. globosum, sometimes considered a form of Gymn. fuscum. The two species occur on J. Virginiana, often together, and are the most striking as well as probably the most common species east of the Mississippi. One would naturally expect that the study of their development would not be difficult. Unfortunately, however, Gymn. globosum is as great a puzzle as ever. In all my cultures this species was the one which always produced the greatest crops of spermogonia. Sometimes they were so abundant as nearly to cover the young plants used for experiments which in some cases soon died, apparently killed by the excessive growth of the fungus. Although spermogonia appeared on several species of Cratægus and on apples, in no case was there the least sign of æcidia. The fungus flourished for a few weeks and then the leaves either dropped off or recovered their normal appearance. Mr. Thaxter has had precisely the same experience except that he also found spermogonia on Pyrus Americana, a host which I had not tried in this case. He had the same luxuriant growth of spermogonia on Cratægus but no trace of æcidia. No explanation can be offered for the failure to obtain æcidia for, at first sight, the conditions seem more favorable than in any other species. Nor is it possible from the distribution to guess with what Roestelia it is connected if we exclude R. aurantiaca which, as we have seen, followed the sowings of the spores of Gymn. clavipes. It is out of the question to consider Gymn. globosum and Gymn. clavipes as forms of one species both from their habit, microscopic structure, and the distortions produced. The species to which it appears to be most closely related and with which it is even identified by some writers is Gymn. fuscum, a species which is considered by European botanists to have for its æcidium Roestelia cancellata which grows on Pyrus communis. Now although in this country one often finds pear trees growing close to red cedars attacked by Gymn. globosum there is not a single undoubted instance of the occurrence of Roestelia cancellata in this country and the few herbarium specimens bearing that name are more than doubtful. R. cancellata is one of the most easily recognized forms and it is hardly credible that it has escaped the observation of our botanists unless it is very rare indeed while Gymn. globosum is very common.

With regard to Gymn. macropus we have more definite information, although here, unfortunately, the case is not quite clear. This species has been studied more than any other, not only on account of its great size and abundance, but also on ac-

count of its supposed relation to diseases of apple trees. My cultures seemed to point to a connection with some common Roestelia on apples, and, I suspected, judging by what I had seen in orchards near infected cedars, that it might be the minute form generally considered a variety of R. lacerata, which is very common in the east. In my cultures I found only spermogonia. During the past spring cultures were made by Prof. B. D. Halsted, at Ames, Iowa, and by Mr. Thaxter, at Cambridge, and I found an instructive case at New London, Ct., to which I will refer later. Many have probably read the account of Prof. Halsted's experiment, in a recent number of the BOTANICAL GAZETTE, and, with the author's consent, I will state briefly the result. Early in the season, specimens of Gymn. macropus were gathered and allowed to develop under cover, so that there need be no danger of mixture with spores from outside. The germinating spores were then sown on the young leaves of a wild crab apple, Pyrus coronaria. The leaves and tips of the branches sown were then covered with small bags, and about three weeks later there appeared an abundance of spermogonia. The experiment was repeated on other twigs with a similar result later, and in both cases the fungus had developed to a marked degree before there was any trace of spots caused by natural infection on parts of the tree which had not been covered. In time the æcidia appeared and proved to be what has usually been called Roestelia penicillata.

To turn for a moment to Mr. Thaxter's cultures. The spores of Gymn. macropus were sown on Pyrus Americana, Cratægus coccinea, apples, Amelanchier, and Pyrus arbutifolia, but spermogonia appeared only on the apples. The cultures were continued and on July 14 a small number of æcidia appeared and grew slowly. Unfortunately, the æcidia have remained small, and the determination can not be made with certainty, but it must be admitted that they give one the impression rather of the small form of lacerata than of penicillata. It may be added that the wild specimens of R. penicillata had already developed at this time, and it is not probable that the æcidia in Mr. Thaxter's cultures were any later in developing than the wild form.

In the latter part of June I noticed at New London what might be called a natural culture of Gymn. macropus on a wild apple. A small J. Virginiana and a small apple had grown together in such a way that they seemed to form but one tree. My attention was first attracted by the immense number of bulbs of the Gymn. macropus on the cedar. They were so numerous as to make it look like a decorated Christmas tree. I had never seen a cedar so covered with the Gymnosporangium and at the

same time the apple was yellow with the spermogonia of a Roestelia, at the time immature, but which afterward developed into a form of R. penicillata. It might be asked why, judging from Prof. Halsted's culture and the New London specimens, we should not consider the R. penicillata to be the æcidium of Gymn. macropus, for Mr. Thaxter's culture, while it seems to point to a different conclusion, is not sufficient in itself. If we look at the opinions of European botanists we find that they differ very much with regard to R. penicillata. On anatomical grounds alone, some regard it as merely a form of R. lacerata. Others, like Winter, think it distinct. From their cultures, also, they have not reached a definite conclusion; for, while Oersted thinks that R. penicillata is the æcidium of G. clavariæforme, Rathay maintains that it is a form of Gym. conicum. Oersted considered that he obtained both R. lacerata and R. penicillata from sowing the spores of Gymn. clavariæforme on Cratægus and apples respectively, but it is claimed that he never really obtained the æcidia on apples but inferred that the spermogonia on apples must belong to R. penicillata. But such an inference is not strictly logical. In American cultures Gymn. clavariæforme was followed only by R. lacerata not by R. penicillata which is in confirmation of the views of those who are opposed to Oersted's conclusion. In other words, the undoubted Gymn. clavariæforme on J. communis in this country acts when sown just as that species is said by the opponents of Oersted's view to act in Europe. If we accept Oersted's view we must accept the view that Gymn. macropus of this country is only a form of Gym. clavariæforme which grows on J. Virginiana. This is the view of Schroeter, but it is difficult for botanists in this country, who have seen both species growing, to regard them as forms of a single species. It may be true, however, and the important point for our botanists to settle is, can the spores of R. penicillata be made to grow on both J. communis and J. Virginiana and produce on the former what we now call Gymn. clavariæforme, and on the latter what we call Gymn. macropus.

The Theory of Immunity from Contagious Diseases.*

D. E. SALMON.

The immunity which an individual acquires from the effects of a contagion, by passing through one attack of the disease which it causes, has never been completely and satisfactorily ex-

*Read before the A. A. A. S., Buffalo meeting, 1886.

plained. Various conjectures have been offered, but no one of these to my knowledge has been based upon sufficient direct and positive evidence to warrant its acceptance as a well established theory of immunity. Since the demonstration of the germ theory of contagion, it has been evident that there were, in a general way, three possible explanations of acquired immunity, viz: a substance might be formed in the body during the course of the disease which is unfavorable to the microbes; or a substance essential to the growth of these microbes might be excreted or in some way lost or destroyed during this period; or, finally, the living matter of the body might acquire the power to resist or prevent the growth of the microbes.

It is well known that Pasteur has adopted the second or exhaustion theory, and sustains it by his observations on the growth of microbes in culture liquids contained in flasks. If we sow chicken bouillon, he says, with the microbe of fowl cholera and after three or four days filter the liquid in order to remove all traces of the microbe, and afterwards sow this parasite again in the filtered liquid, it will be found powerless to resume the most feeble development. He assumes that there are but two hypotheses by which this fact can be explained: either the microbe has exhausted something from the culture liquid essential to its multiplication or it has added some substance which is unfavorable to it. To decide between these two possibilities a culture of the microbe was evaporated *in vacuo* without heat, and then brought back to its original volume by the addition of fresh culture liquid. He reasoned that if the growth of the microbe had been arrested in the culture by the formation of a substance which acted as a poison upon it, then the activity of the microbe would not be renewed after the addition of the fresh liquid since the volume had not been increased and all of the chemical principles were retained. As a matter of fact the multiplication of the microbe was renewed, and consequently the antidote theory was rejected and the exhaustion theory adopted.

Doubtless M. Pasteur's conclusion is correct as applied to the growth of microbes in flasks, but when we take into consideration the conditions under which such organisms multiply in the animal body, we find the elements of the problem very materially changed. The body is very different from a culture flask to which nothing gains entrance and from which nothing is elimiinated. The insusceptible fowl is continually taking into its system fresh food which contains principles suited to the growth of the microbe in question. If the body is to be compared to a culture flask we should expect the immunity to be at the most of

but a few days' duration, since the fresh nutriment should increase the capacity for growth in the one as well as in the other. Immunity from contagious diseases, when once acquired, however, does not terminate so soon, and generally persists for years.

The exhaustion theory is susceptible of being tested by direct experiment. If a fowl is insusceptible to cholera because it lacks some element essential to the growth of the microbe, then bouillon made by infusing the muscles of this fowl in distilled water should also lack this same element and would therefore be equally incapable of nourishing the germ. In February, 1881, the writer was investigating the subject of fowl cholera, and made this experiment; and he found that the proliferation of the microbe was just as vigorous in bouillon made from insusceptible fowls as in that made from susceptible ones (Rep. U. S. Dep. Ag., 1881 and 1882, p. 292).

Both the antidote and the exhaustion theory, consequently, fail when tested by direct experiment; indeed when we consider that there must be a different chemical substance exhausted from the body for each contagious disease against which immunity is acquired in the one case, or a different product for each disease added in the other case, the theories become at once improbable.

If we direct our attention now to the third or vital resistance theory, such discrepancies in regard to well established facts will not be found. Immunity is probably never absolute, but simply relative. Chauveau found that the Algerian sheep, supposed to be insusceptible to charbon, would succumb to that disease if a sufficiently large dose of virus was administered, and the writer found that fowls insusceptible to ordinary doses of cholera virus would contract the disease if the dose was sufficiently increased (*loc. cit.* p. 289). By turning these experiments in the opposite direction, I found that the effect of virus upon susceptible fowls varied to a certain extent with the dose, and a point was finally reached at which no symptoms of disease were produced, although some of the most virulent germs were introduced into the body (Rep. U. S. Dep. Ag., 1883, p. 48)

These facts indicate that the tissues of the most susceptible individuals are not suited to the growth of microbes when the functions of the cells are normally performed; because, if favorable, one germ introduced into the interior of the body would multiply just as it does in a culture flask and finally produce the disease with the same certainty as would a million. This not being the case, it is evident that by increasing the dose the resistance of the tissues is in some way overcome, the microbes multiply and the disease is produced. If the germs failed to multiply

when a small number were introduced, because there was something lacking in the constituents of the body which is essential to their growth, it is difficult to understand how this unfavorable condition can be overcome by increasing the dose of virus; or if the failure to multiply was due to the existence of some substance which acts as a poison to the microbe, it is equally difficult to conceive how a large dose of virus would insure proliferation when a small one fails.

That the influence which prevents the multiplication of the microbes is connected with the vital activity becomes more probable from the fact that the bacteria of putrefaction, organisms closely related to the pathogenic microbes, are unable to reproduce themselves when introduced into the tissues; but they find favorable conditions for growth there as soon as the life of the tissue is destroyed.

With these various facts in mind, we are prepared to understand how immunity results from one attack of a contagious disease. The cells of the body are at first depressed in their activity or narcotized by the poison of the microbes, but after being subjected to its influence for a certain length of time they acquire a tolerance for it just as people begin a tolerance for tobacco and are able to smoke and chew it without inconvenience, although the first attempt made them deathly sick. Of course as this tolerance is gained the tissues resume their vital functions as before, the liquids of the body become unfavorable to the existence of the microbe and it perishes. From that time forward for a considerable, though indefinite and variable, period the animal enjoys an immunity from that particular microbe when introduced in limited doses; but just as almost any one can be made sick by sufficiently increasing the dose of tobacco, so the immunity of most individuals may be overcome by administering a very large dose of virus.

[The discussion of observations and theories made by Metschnikopf, Chauveau, Zülger, Riemschneider, Hiller, Pasteur, and the author, which bear upon the elucidation of the subject, but do not affect its general statement, have been omitted for lack of space.—EDS.]

If these conclusions are correct, then we should be able to develop immunity by introducing into the body the poisonous products of bacterial growth which have been freed from all living organisms. This result would be a most decided advance in the preventive treatment of contagious diseases. Investigations of this question have not been as numerous or thorough as is desirable. Pasteur found that his fowls which had been treated

with the narcotic above referred to were still susceptible. The writer made many experiments with the same poison, which were also negative in their results. Law has published experiments with swine plague from which he claims positive results, but the number of animals operated upon is too limited to be at all conclusive, even if the details of the experiments were satisfactory, which is not the case. Quite recently in our experiments pigeons have been granted a very complete immunity from the effects of swine plague virus by treating them with cultures of the microbe in which all living organisms had been previously destroyed by heat. Up to this time, however, our experiments with pigs have only given negative results.

Although there are still some points in connection with this subject which greatly need experimental elucidation, it is believed that the theory developed in this paper is in accordance with the facts so far demonstrated. The problems of immunity have long been considered impenetrable mysteries, and if this theory does not prove in all respects correct it is hoped that it may at least be of some service to other investigators.

BRIEFER ARTICLES.

Dr. Gray's letter to the Botanical Club.—*To the Botanical Club of the A. A. A. S., at Buffalo:* I am unable to attend the ensuing meeting of the Association. But wishing to manifest my interest in the Botanical Club, and to show that I am not altogether an idler in the camp, I send herewith two small papers,* containing the result of some recent systematic work upon two familiar genera.

They are not readable papers, and therefore should not be doled out at your sessions, which will naturally be occupied with more interesting and discussable communications. I can not even make an abstract of them, which would be much more readable than the papers themselves. But the few lines prefatory to the essay on Dodecatheon will sufficiently explain that undertaking, and the result, which has given me no small satisfaction. For we have always felt confident that there were distinct western species, although I have never till now found a clew to lead toward the extrication of the various forms.

I am glad to find that only one really new name will be needed in the nomenclature of the five species which we have presented.

As to Violets, I make out thirty-three wild North American species, of which only eight are represented in the Old World. In two instances, namely, in the *Palmata* and *Blanda* groups, I have kept up recognized species, which almost every botanist believes to be confluent, but is yet not disposed to suppress.

* The paper on Dodecatheon published in this issue, and that on Violets in the next

I have arranged our species in a series of natural groups, which are pretty clearly defined by means of a combination of characters. There are one or two changes in nomenclature; but the only notable ones are in the second group, where *V. pedatifida* replaces the much later name of *V. delphinifolia*, and the Linnæan name of *V. palmata* asserts its right of priority over *V. cucullata* of Aiton. If we did not fall back upon this name we should have to take up *V. obliqua* of Hill, which is much earlier than *V. cucullata*, and is clearly of that species, as Hill's figure shows.

I crave the opinion of the club as to whether our Pansy-Violet, *V. tricolor*, var. *arvensis*, is indigenous to this country. In deference to those who have more knowledge of the matter than I have, this is here included among the wild species, yet with misgiving.—ASA GRAY.

Orange-leaf scab.*—During the past two seasons the Department of Agriculture has been receiving orange leaves that were diseased in some way. Mr. Charles W. Campbell, of Ocala, Florida, writes that the disease appeared first last summer and is rapidly increasing, especially attacking young and vigorous trees. It is very destructive to the growth of the trees and ruinous to young nursery stock, so that it is feared it will seriously affect the orange interest. There seems to be no literature upon the subject, and there is a probability that the disease is new, at least it is of very recent appearance in Florida. The entomologists affirm that there is no evidence of its being caused by insects.

The first appearance is that of small, light-colored, wart-like excrescences upon the leaf surfaces and young shoots. These develop, often become confluent, and finally destroy the vitality of the leaf. The top of the older warts is dark brown or nearly black, due to the presence of a dense fungous growth, made up of a multitude of irregularly developed conidiophores, bearing oblong one-celled conidia. Whether this particular fungus is the cause of the disease it accompanies I can not at present say.

Upon some specimens recently received Mr. J. B. Ellis discovered a species of Fusarium which he believes to be *F. sarcochroum* Desm., and expresses the opinion that the warts are caused by the mycelium of this fungus. After careful examination, however, I am inclined to think that the disease is caused by the first fungus referred to above

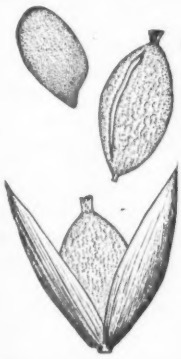
From letters received from De Land, Florida, we learn that (1) trees affected last season were the first attacked this spring; (2) sour trees alone are affected; (3) soil and surroundings have no influence on the disease; (4) vigorous and "sickly" trees are alike attacked; (5) the disease tends to spread throughout the whole tree; (6) the disease does not spread in the grove, but appears at several points simultaneously.

It is recommended that the following fungicides be tried: (1) a solution of potassium bisulphide; (2) liquid grison†; (3) strong soap suds containing glycerine and carbolic acid. Of course all these solutions should be applied in the form of fine spray.—F. LAMSON SCRIBNER.

*Abstract of a paper read before the Botanical Club of the A. A. A. S., Buffalo meeting, 1886.

†Prepared by boiling three pounds each of the flour of sulphur and lime in six gallons of water until reduced to two gallons. When settled pour off the clear liquor and bottle for use. In use this liquid should be much diluted with water (1 to 12).

Expulsion of the seeds of Sporobolus cryptandrus.*—The caryopsis of most Gramineæ contains a seed which firmly adheres to the pericarp. Sporobolus and some others have long been known as exceptions to this rule. The ovary of Sporobolus is very thin and tender. Free seeds may often be seen still adhering to various portions of the glumes and branches of the panicle. One of my special students, at my suggestion, has made a few experiments to determine the mode in which the seed escapes. Inside the ovary and about the seed there is a gummy secretion. When about ready to escape or at a certain stage of maturity, if water be applied to the panicle, in a short time the seeds come forth. A part of a panicle was wet and in 30 minutes 27 seeds escaped; in 37 minutes 40 seeds had escaped. In another case the seeds began to escape in ten minutes after the water was applied. After drying six days in a room seeds started out twenty minutes after wetting. In other cases seeds were seen to escape in six minutes, and in one case in four and one-half minutes. If the ovary is carefully removed from the floral glume and palea, and water is applied, the seed usually escapes a little quicker than when left in the floret.



On applying water the ovary may be seen to slowly enlarge till it bursts and the seed pops out in a hurry. If a little water is applied, it moves more slowly, and if the glumes are still near the ovary the seed moves upward and usually adheres to some part of the panicle. A slight sprinkling or a heavy dew would bring the seeds out, but a heavy rain would wash them down at a time when the condition would be favorable for germination. Several other species, as I judge from herbarium specimens, expell and hold their seeds in a similar manner. The action of the water on the ovary seems to be purely mechanical and is explained in well known works on physics. The water enters the ovary faster than the gum can escape. The ovary is flattened and splits on the side next the palea.—W. J. Beal.

The Biology of timber trees with special reference to the requirements of forestry†—It is most necessary for forestry purposes to thoroughly understand the biology of the timber tress to be propagated, as injudicious methods of propagation, selection of unsuitable species and improper after-treatment may occasion heavy financial loss, the results being visible only after many years of investment. The selection of the material for forestry purposes out of the 420 arborescent species is made difficult by the absence of knowledge as to the true value not only of the timber, but the growing capacities of our trees.

A classification may be made into dominant species, which are capable of

*Read before the Botanical Club of the A. A. A. S., Buffalo meeting, 1886.

†Portion of an abstract, by the author, of a paper read before the A. A. A. S., Buffalo meeting, 1886.

forming extensive forests, co-ordinates, which may be occasionally grown in extensive plantations for their economic value, though properly not desirable for dominant forest growth, and subordinates which are useful to fill up the forest stand.

The most important qualities for the consideration of the forester, possessed by different timbers in a different degree, are the relation of their development to the influence of light, shade, and rate of growth. A classification into shade-enduring and light-needing species in a general series is possible. The relative requirements as to light must be studied in the dense forest, where no side light changes the habit of forest growth. The capacity of trees to endure shade is manifested by the density of their foliage and by the tenacity in sustaining life of lower branches and overshadowed individuals. Conditions of site modify the requirements for light. Alpine floras become light-needing floras; cloudy climes increase requirement of light and southern skies diminish it, so do humid atmospheres.

As the preservation of soil humidity becomes a necessity all over the world only such species as are capable of shading the soil against undue evaporation should be chosen for the dominant forest. These are the shade-enduring ones.

A study of the form-development must precede consideration of rates of growth. Trees may be classified according to their greater tendency to develop the bole or the crown. Their true habitus must be studied in the open; the dense forest influences the development especially of the latter class, it stimulates height-growth. Soil, situation and age influence form-development, the energy of height-growth being increased in fresh and deep soils, while shallow and compact soils, altitude, cold winds reduce this energy.—B. E. FERNOW.

EDITORIAL.

IT IS PROBABLY safe to say that the botanists form the best compacted organization of scientific workers in the country. Their work demands the most widespread exchange of facts, and this has led to correspondence which has often ripened into friendship. This can be plainly seen at such meetings as the one just held at Buffalo, and the Botanical Club is doing a great thing in fostering these friendships and binding together still more firmly widely scattered workers. A spirit of courtesy is prevalent, the spirit which prompts to render every possible service, and respects the rights of one who is already occupying some special field. The whole field of botany is so large that there is an abundance of room for every one without jostling. The stimulus of these annual meetings in directing botanical activity can hardly be overestimated. Never before has there been such botanical activity in this country, and no small part of the cause is due to the botanical journals which supply the means of speedy publication, and the meetings of the Botanical Club, which bring all workers into more sympathetic relationship. We would urge upon botanists who have not already mapped out their work that they select at once some convenient subject for investigation during the coming year, so that at their

next meeting they may have something of interest to present which will be a real contribution to science. The thing to be criticized in many of our botanists is the aimlessness of their work. One year is much like another, and consists in the collection of specimens, the finding of new stations, or the observation of a few unimportant deviations from published descriptions. It is true that the days of announcing albinos is past, but there ought to be a more decided settling down to some special work. On the other hand, the mistake should not be made of selecting some subject far too difficult, which is beyond the range of the worker both in experience and material. The commonest materials and the easiest subjects are the best to work, for they imply a sufficiency of ability and material. The young collegian thinks of stopping nothing short of reorganizing the universe, and the ambitious young botanist is something like him. The work that is nearest at hand is the work to be done, and no subject, however unpromising at first, will fail to open up to patient work all the opportunities desired. In the selection of a subject advice should be asked of those more experienced, else a perfectly useless work may be undertaken, or one that has already been done in a much better way. Collecting and exchanging are all good enough in their way and necessary, but they simply furnish material for work, and that they are to represent the height of a botanist's ambition can not be too strongly decried. Every botanist should become an original observer and not simply lead a tread-mill existence. All this is not by way of saying that the botanists of this country are not at work, for there is an abundance of good work being done, but simply to stimulate the many who are not at work as they should be.

SOME MENTION is made elsewhere in this issue of the present status of botany in the Department of Agriculture at Washington. It is evident there has been expansion, which has resulted in leaving the original botanical division as strong as before, and in some respects stronger, while there has been a distinct gain in establishing the study of plant diseases as a separate and clearly recognized portion of the Department. It remains to be seen if this good beginning can be maintained, and made the fulcrum for higher and broader work. An institution which depends upon annual appropriations for its income, and which must rise step by step from small beginnings to its full measure of usefulness, needs the support of a strong public opinion to save it from the numerous pitfalls that annually beset its progress or possibly its existence in legislative halls. The botanists of the country should constitute one of the important forces in sustaining this new enterprise. The committee of the A. A. A. S., which has heretofore lent assistance, is now disbanded, and botanists should consequently feel that such responsibility as may exist lies with them individually.

AT THE TIME the August number should have been prepared for press the editors were taking their vacation—the senior editor with a party in Indiana, one of the others in the mountains of West Virginia, and the third on the shores of Vermilion lake, in Northern Minnesota. If any short-comings are observed in that number our subscribers will have no difficulty in surmising the cause.

OPEN LETTERS.

Drying Plants.

On reading the Herbarium number of the GAZETTE I noticed that none of the writers on specimen making had mentioned a plan adopted by myself a few years ago, while botanizing in Nova Scotia. Though not to be recommended for common use as the specimens fall short of those obtained by the ordinary methods, yet, if so situated that an abundance of driers is not obtainable, or, if the climate be so foggy and wet that they can not be properly dried, I think it will be found of practical value. On the trip referred to a large number of specimens had been collected, but so bad was the weather from rain and sea fogs that there was great danger of losing them all. Under these circumstances advantage was taken of occasional glimpses of sunshine in the following way: each sheet of specimens was placed between two driers and these were spread in a single layer on the floor of an open balcony. Pieces of board placed in the sun, logs or bark, would of course answer the same purpose. Small stones laid on the corners of the sheets prevented the wind disturbing them, and no pressure was used except the weight of the single drier covering the specimens. An hour of good sunshine served to fully cure most plants. This plan is only applicable to specimens previously somewhat wilted in the press, as the leaves of fresh or insufficiently wilted ones curled up from the absence of pressure.

London, Ontario, Canada. T. J. W. BURGESS, M. D.

A Collection of Exotics.

In reply to the suggestion of Prof. W. W. Bailey concerning exotics in the herbarium, I may state that in the herbarium of the United States National Museum we have undertaken to form precisely the kind of a collection he mentions.

It is the policy of the National Museum to publish, in the form of bulletins, investigations upon the natural history of various interesting localities. With this in view Prof. Baird issued a circular bearing date of March 1, 1883, requesting information and lists of the cultivated plants of the District of Columbia. A committee of botanists was also appointed by the Biological Society of Washington to assist in the collection and preparation of this material. For several years but little was accomplished, but on the formal establishment of an herbarium in the museum the matter was taken up with energy. A competent collector, who is also a practical gardener, was employed, and several thousand specimens have been collected from the public parks and greenhouses.

As many of these plants are being cultivated without scientific names the first work will be their proper scientific determination. This will often be a matter of great difficulty, as their native country will be unknown, and moreover exotics that have long been cultivated are generally burdened with an extensive synonomy, but with a good named herbarium of foreign plants for comparison much may be accomplished.

When finally mounted for exhibition or study each specimen will be labeled with its accepted scientific name, the common name under which it is cultivated, its native country, and such other data as will be likely to be of interest. As for keeping these specimens separate from the general herbarium, we shall probably not be able to do so on account of limited space, although the suggestion of Prof. Bailey to this effect may be a good one. At any rate a collection of this character will furnish a source of popular information of undoubted value. F. H. KNOWLTON.

United States National Museum.

Sinteni's Puerto-Rico Plants.

[Translation.]

The distribution of the first installment of plants collected by T. Sinteni at Puerto-Rico has just taken place. The determinations have been made by the undersigned in company with several monographers. As but a few sets are yet to be disposed of (at 30 marks per hundred) intending purchasers must send in their names speedily. The species lacking in this issue will be supplied (possibly completely) from shortly to be expected collections.

Schöneberg bie Berlin, Grünewald. DR. IGN. URBAN.

NOTES AND NEWS.

DR. H. F. HANCE, British Consul at Amoy, China, died on June 22. He has been an earnest student of the plants of the East, having described a large number of new species, mostly in English periodicals.

MR. ROMYN HITCHCOCK, editor of the *American Microscopical Journal*, has sailed for Osaka, Japan, which will be his address for some time to come. The business management of the *Journal* is placed in the hands of Rufus W. Deering, of Washington, D. C.

A NEW monthly botanical journal, to bear the name *Malpighia*, wil lsoon be started at Messina, Italy, to be edited by Professors Borzi, Penzig, and Pirotta. It will contain original articles, bibliography, critiques, notes and queries. The subscription is placed at twenty-five francs per annum.

PROFESSOR F. L. HARVEY, of the Arkansas Industrial University, has accepted the position of professor of natural history in the State College, Orono, Me., made vacant by the resignation of Professor C. H. Fernald, who takes the chair of zoology in the Massachusetts Agricultural College.

A CRITICAL SYNOPSIS of the North American species of the genus Carex by Prof. L. H. Bailey, Jr., will shortly appear in the proceedings of the American Academy. Contrary to the usual custom of American botanists the territory covered includes Greenland, Mexico and Central America, *i. e.*, all of North America. Prof. Bailey has been engaged upon the work for three years, and the results of his study will be heartily welcomed.

THE BUFFALO MEETING of the Society for the promotion of Agricultural Science listened to the following papers pertaining to botany: Parasitic fungi as affecting plant distribution, by W. J. Beal, Ph. D.; On some diseases of cultivated plants, by W. G. Farlow, M. D.; The sources of nitrogen of plants, by R. C. Kedzie, M. D.; Vitality and germination of fruit tree seeds, and Comparative growth of young timber trees, by W. R. Lazenby, M. Sc.; Hybridity in nature and its effects, by T. V. Munson, M. Sc.; A study in agricultural botany, by E. L. Sturtevant, M. D.; The agricultural grasses of Arizona, and The mildews of the grape, by F. L. Scribner, B. Sc.

A PLANT of Yucca filamentosa of remarkable size and habit bloomed last year in the Botanic Garden at Adelaide, South Australia, and is figured and described by Dr. Schomburgk, the director, in his last report. It is about twenty-five years old, is 18 feet high and 7 feet 4 four in circumference one foot above the ground. It bloomed for the first time in 1873, producing an upright flower-stalk. When this was cut away, a number of short branches were produced, forming a globular head of foliage. Last year when it bloomed for the second time, it threw out eight flower-stalks, three feet long and bearing three hundred flowers each, but instead of being upright, they were fully pendulous. It is said to have been a magnificent sight, as can well be imagined.

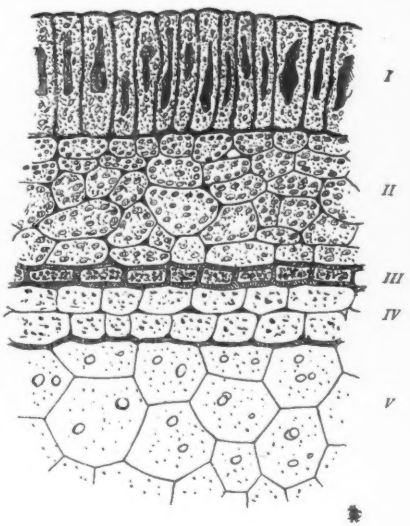
THE COMMITTEE of the A. A. A. S. for securing more favorable ruling regarding the transmission through the mails of herbarium specimens with written labels reported that much attention had been given toward securing the desired object but no result had been reached. The committee were met with the objection that it was asking legislation for

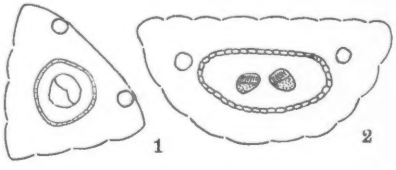
too small a class to be worth while. To overcome this obstacle the name of the committee is now changed by the substitution of the words "natural history specimens" for "botanical specimens," and the committee is strengthened by adding Prof. S. F. Baird, of the Smithsonian Institution as Chairman. The other members are Profs. L. F. Ward, J. W. Chickering, Jr., and Dr. Geo. Vasey. The committee on the health and diseases of plants reported that it had accomplished the chief objects in view and was discontinued.

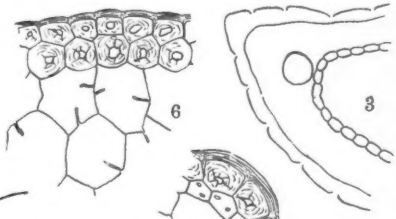
REFERENCE WAS MADE in the May issue to the condition of the botanical part of the Department of Agriculture, and the efforts to secure a suitable appropriation for the present year. For awhile after that was written the prospect was gloomy, and fears were entertained that recent advancement might be lost if appropriations were cut off. At this juncture the committee of the American Association on the health and diseases of plants addressed a memorial to Congress setting forth the desirability of investigations upon the fungous foes of the cultivator and the necessity for an appropriation of fully $5,000 with which to carry on the work. This was effectively presented by Prof. Riley, to whose exertions and those of Commissioner Colman the credit of finally securing the favorable action of Congress is largely due. The result has been, that the work on the diseases of plants has been separated from the botanical part of the Department, now raised to the dignity of a Division, and has been placed in full charge of Mr. Scribner, who reports directly to the Commissioner. This leaves the position of assistant botanist vacant. An appropriation of $5,000 was obtained, of which $840 goes to the Botanical Division to be expended chiefly in studying the agricultural grasses of the West, and the balance, $4,160, is to be used for the investigation of the diseases of plants, and for the salaries of those employed. Although this is much less than originally contemplated, yet it is an excellent beginning.

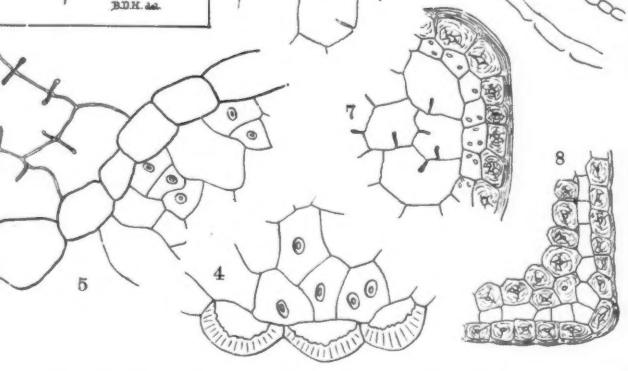
LATHRÆA SQUAMARIA, a common Orobanch of Europe, has been studied by Mr. George Massee and described, with a plate, in the September *Journal of Botany*. It has for a long time been considered a true parasite upon the roots of elm, ash, hazel, and beech. After germination, a full season is devoted to the development of vegetative organs and the accumulation of reserve material. The second year's work is confined to the production of reproductive parts. After fully describing the structure of the haustoria, leaves, etc., and also the results of chemical tests, the author concludes: "Although Lathræa has up to the present been described as a parasite, which to a certain extent is correct, more especially while young, yet we consider it much more of a Saprophyte than a parasite, scale-leaves never being absent; whereas the discs, upon which its parasitism depends, are, as the plant becomes old, frequently very rare, or apparently altogether absent, while in other instances roots and discs are very numerous on old plants; their presence or absence depends entirely on the position in which the plant finds itself; if small living roots of a suitable host-plant are present they are developed, whereas, if the plant has migrated to a locality from which they are absent, it possesses the power of supporting itself by means of its scale-leaves." It may be interesting to mention that the roots are sometimes covered with the mycelium of a fungus, such as described by Kamienski as about the roots of Monotropa, but not with sufficient constancy to admit of the theory of symbiosis.

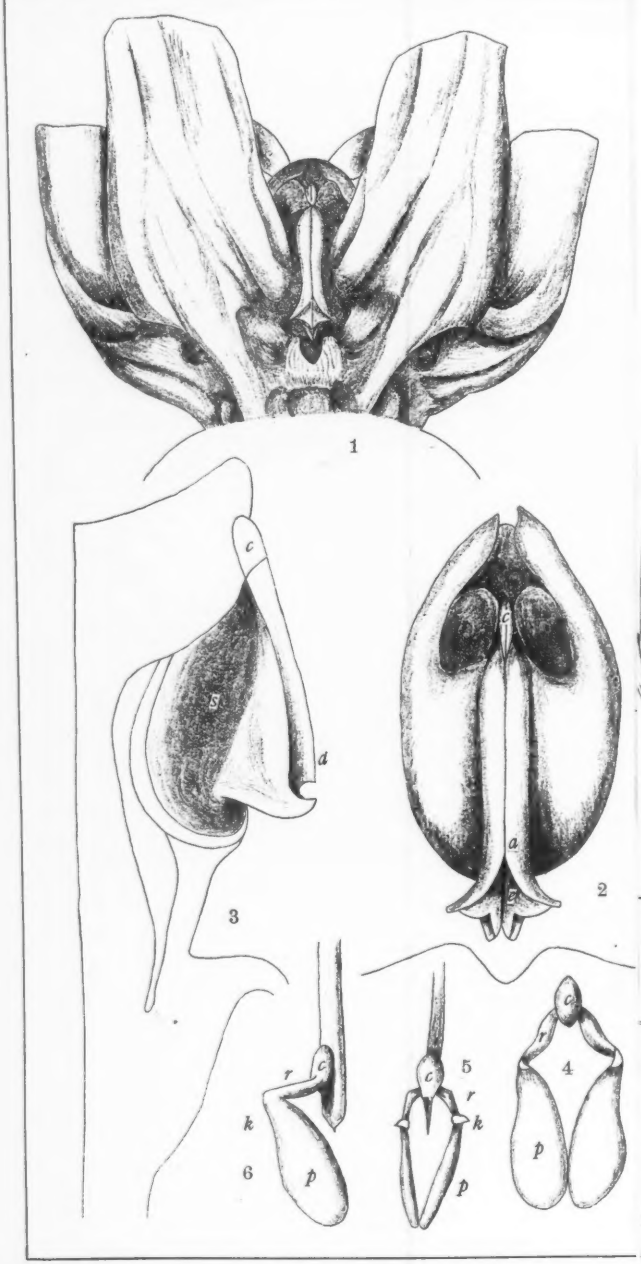
a
B.D.H. del.


I
II
III
IV
V


1
2


6
3


5
4
7
8


1
c
s
d
3
a
2
b
a
r
c
k
6
p
5
c
r
k
p
4
c
r
p
5